SIS55: Benefit of IoT and Big Data for Automated driving and User Trust Challenge

SIP-adus: Japanese Automated Driving Project

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October 31, 2017
1. Connected and automated driving project in Japan

2. Dialogue with the general public on acceptance of automated driving

3. Privacy issues related to data collection of vehicle location
Cross-Ministerial Strategic Innovation Promotion program
Innovation of Automated Driving for Universal Services

“SIP- adus”

- Mobility Bringing Everyone a Smile -

Inclusive society, where diverse people in diverse communities actively participate in generating values, will enhance both wellness of individuals and economic development. Automated driving technologies integrated with social innovations should provide everyone with mobility to fully exercise his or her capacity, enabling sustainable development of the society.
Technologies for Automated Driving Systems

Vehicle

<Recognition>  <Judgement>  <Operation>

Map, ITS info., Sensor  AI  Actuator

HMI

Human Machine Interface

Cooperation w/Human

Onboard Sensors

GNSS  Laser Scanner (LiDAR)  Camera  Radar

Important Technologies
- Self-position estimation
- Neighboring environmental recognition

Dynamic Map

ITS Predictive Information

High Definition 3D Map

Basic Tech.
Security, Simulation, Database, etc.

SIP-adus focus on R&D in Cooperative area with Industry, Academia and Government

In red : Area of Cooperation ⇒ Main Area of SIP-adus
Vehicle Position Detection using Dynamic Map

Sensed Data

High Definition 3D Map

Compare to estimate the position

GNSS  Laser Scanner(LiDAR)

Radar  Camera

Traffic Signs

Estimate the position of the vehicle

Traffic Signs

Carriageway

Carriageway Line

Road Shoulder
Dynamic Map

Dynamic Data
Movement of Vehicles, Status of Pedestrians, Traffic Signals etc.

Semi-dynamic Data
Accidents, Traffic Jams, Detailed Weather etc.

Semi-static Data
Traffic Regulation, Road Construction, Weather etc.

Static Data
= High Definition 3D Map
Road, Lane, 3D Shape of Structures etc.

Digital Mapping

Various Uses

Base

3D Common Platform Data
Point Clouds, Graphics, Probe Data etc.

Platform

Link

API

OEM

API : Application Program Interface

Combine various data
Connected Vehicles (V2I&V2P)

Sensor for Vehicles and Pedestrians

Antenna

Onboard Display

Mobile Device
Connected Vehicles (V2Network)
Cyber Security

User Friendliness (JAMA)

- Common Architecture Model
- Use Cases of Automated Driving (JAMA)
- Threat Info. (JPCERT/CC, Auto-ISAC)
- Evaluation (Attack) Info. (Auto-ISAC)

Vulnerability Evaluation

- Countermeasure
- Level of Countermeasure

Threat Analysis Tool

Comparison with Current Threat Analysis (JasPar)

Cyber Security Evaluation Guideline
Human Machine Interface

Automated Vehicle / System Levels 2,3,4 and 5
Impact Assessment: Accident Reduction

Real Traffic Flow Simulation

Traffic accidents reduction simulation “Multi Agents”

Traffic Accident Analysis

Effect Prediction

Simulation result

[Simulation Parameters]
- Levels of Automation
- Diffusion of Automated Driving Vehicle
- Error Action(driver/pedestrian)
- Traffic Flow Density
- Number of Pedestrian etc.

Five major scenarios

- Rear End
  - Collision Warning
- Lane Departure
  - Advanced Emergency Braking
- Pedestrian Crossing
  - Lane Departure Warning
- Head-on
  - Lane Keeping Assistance

Traffic Accident Reduction

Contributions by ADVs

- ADV
  - W/ 60%  W/o 40%
- Man.DV
  - 50%  10%
- Ped.
  - 30%  25%
- ...

Number of
- Fatality
- Severe Injury
- Slight Injury
- Near-Accident
- Traffic Jam Due to Accident etc.
Impact Assessment: CO₂ Reduction

Current: Congestion due to speed change

- Speed Change caused by Road Environment
- Speed down due to Sag
- Speed Change caused by Surrounding Vehicles
- Unnecessary Lane Change
- Unnecessary Acceleration/Deceleration

ADV: Smooth Flow

CO₂ Reduction
Field Operation Tests

«Purpose»
1. To activate the R&D
2. To prove each elemental technology
3. To enhance international cooperation and harmonization
4. To Build Social acceptance

«Period»
Autumn 2017 ~ beginning of 2019

«Main themes»
- Dynamic map
- Social acceptability promotion event
- HMI
- Cross subject for each themes
- Next generation urban transportation
- Information security
- Pedestrian accident reduction

«Participants»
- OEM/Supplier
- University/Research organization
- Ministries, government officers
- Foreign OEM/supplier
- Journalist
Field Operation Tests

≪Participants≫

Alphabetical order
Field Operation Tests

Expressway

- 300 km stretch in Tokyo Area
- Joban expressway
- Tokyo Metropolitan expressway
- Tomei expressway
- Shin-Tomei expressway

Sites

- Test facility: Japan Automobile Research Institute
- Arterial roads: Tokyo waterfront city area
Contents

1. Connected and automated driving project in Japan

2. Dialogue with the general public on acceptance of automated driving

3. Privacy issues related to data collection of vehicle location
Dialogue: Objectives and settings

To foster social acceptance of connected and automated driving technologies, general public, students, professional drivers and fleet managers were invited. Basic knowledge and implications were presented and discussions were moderated.
Why people move?

1. We are not capable of photosynthesis to feed ourselves!
2. We have reasons to be at specific locations:
   - to earn money to sustain ourselves - workplace
   - to take care of family members - home
   - to satisfy our curiosity, self fulfilment - anywhere
3. We have to move between locations, each of which has most suitable location for its purpose.
4. Means of transportation has secondary importance, with a variety of preferences of individuals and situations.
5. We need to discuss automated vehicles from societal and humanity points of view.
How automated driving affects professional drivers?

1. If taxi business is simply moving people from one place to another, it's already endangered by new / disruptive services.

2. Taxi operators are keen on value added services for customer expectation; assistance for the aged or physically challenged, lively conversation with those who are comfortable with it, ...

3. Safety has the highest priority for public transportation. Automated driving technologies will significantly enhance safety by assisting human drivers.

4. Bus drivers are trained to pay attention to every single passenger all the time and to properly control emergency situations.

5. Human intervention would never be replaced by computers.
What are the concerns about automated vehicles?

1. Questions to be answered before deployment.
   - Who guarantee safety? - product liability
   - Who are blamed in case of crush? - criminal law
   - Who pay for the damages? - civil law

2. Machines would never be perfect, regardless mechanical or computer controlled. There are always risks of unexpected.

3. Experts should show benefits and risks of connected and automated driving technologies with quantitative evidence.

4. The society will decide if they take risks for much larger benefits for the society. Then social framework should be designed accordingly.
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In 2003, HONDA started the 'floating car data' services for their customers, which we now call 'probe car data'. Vehicle locations measured by the on-board systems using Global Navigation Satellite System (GNSS) are collected, analyzed and delivered back to the drivers as a set of traffic information. Other Japanese auto manufacturers followed. ITS Info-communications Forum in Japan conducted a survey to see how general drivers react to such services through a monthly magazine by the Japan Automobile Federation (JAF).
Expectations to applications of connected services

- Driving Support
  - Braking
  - Emergency
- Connected Road Users
  - Warning Assist
- Safety
  - Cellular
  - Wi-Fi
  - DSRC
- Comfort
  - Multi-modal Services
  - Efficiency
- Integrated Mobile Services
  - Personal Applications
  - Business Applications

Source: Survey report by ITS Info-communications Forum, Japan, 2006
## Privacy concerns: installation of locating device

### Source: Survey report by ITS Info-communications Forum, Japan, 2006

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Privacy concerns: reasons for the response

Better services are expected
Privacy could be compromised
Acceptable if identity is protected
Negative to pay cost of device
Consent of installation must be properly handled
Negative to pay network charge
Skeptical about sufficient level of device penetration
Battery consumption
Other
No answer

Source: Survey report by ITS Info-communications Forum, Japan, 2006
1. Non-technological Challenges of social acceptance

2. Fundamental issues
   - Quantitative analyses of societal benefits
   - Quantitative analyses of potential risks

3. Consensus building how we could take risks for benefits
Thank you